CLAIMS

What we claim is:

1. A cathode ray tube comprising:

a vacuum envelope;

an electron gun including a cathode, the electron gun having an axis and comprising first, second, and third beam-forming electrodes, the electrodes having a selected thickness and being disposed perpendicular to the axis and having selected spacings therebetween, each of the beam-forming electrodes having a plurality of aperture clusters therein, the aperture clusters having a plurality of apertures within an encompassing shape;

a main lens, the main lens having a range of adjustable focal lengths; and

a display screen, the display screen being disposed at a distance from the main lens within the range of the adjustable focal lengths so as to focus electrons passing through the plurality of aperture clusters onto the display screen.

2. The cathode ray tube of claim 1 further comprising a layer of insulating material between the beam-forming electrodes.

3. The cathode ray tube of claim 2 wherein the insulating material is a crystalline material or a ceramic material.

4. The cathode ray tube of claim 3 wherein the ceramic material is a melted glass frit.

5. The cathode ray tube of claim 2 wherein the insulating material is a polymer.

6. The cathode ray tube of claim 2 wherein the beam-forming electrodes and the layer of insulating material further comprise a bond therebetween to form a laminated beam-forming electrode stack.

7. The cathode ray tube of claim 1 wherein the first, second, and third beam-forming electrodes are formed from a highly doped semiconductor.

8. The cathode ray tube of claim 7 further comprising a layer of insulating material between the beam-forming electrodes, the insulating material being an oxide of the highly doped semiconductor.

9. The cathode ray tube of claim 1 wherein the number of apertures in each of the plurality of aperture clusters is in the range from about 4 to about 55 apertures.

10. The cathode ray tube of claim 1 wherein the number of apertures in each of the plurality of aperture clusters is in the range from about 6 to about 12 apertures.

11. The cathode ray tube of claim 1 wherein the encompassing shape of the aperture clusters is circular or approximately circular and a diameter or major dimension of the encompassing shape is in the range from about 30 micrometers to about 2500 micrometers.

12. The cathode ray tube of claim 11 wherein the diameter of each of the apertures in the plurality of clusters is in the range from about 15 micrometers to about 500 micrometers.

13. The cathode ray tube of claim 1 wherein the first, second, and third beam-forming electrodes have a thickness in the range from about 1 micrometer to about 150 micrometers.

14. The cathode ray tube of claim 1 wherein the selected spacings are in the range from about 10 micrometers to about 150 micrometers.

15. The cathode ray tube of claim 1 wherein the encompassing shape of the aperture clusters is selected from shapes consisting of rectangular, elliptical, triangular, circular and polygonal.

16. The electron gun of claim 15 further comprising within the encompassing shape of the aperture clusters an area of the electrodes wherein an aperture spacing is increased to values greater than the aperture spacing at the encompassing shape, so as to decrease spreading of an electron beam.

17. An electron gun , the electron gun having an axis, comprising:

a cathode or cathode support, a support bracket and an alignment rod;

first, second, and third beam-forming electrodes, the electrodes having a selected thickness and being disposed perpendicular to the axis and having selected spacings therebetween, each of the beam-forming electrodes having a plurality of aperture clusters therein, the aperture clusters having a plurality of apertures within an encompassing shape; and

a main lens, the main lens having a range of adjustable focal lengths.

18. The electron gun of claim 17 further comprising a layer of insulating material between the beam-forming electrodes.

19. The electron gun of claim 18 wherein the insulating material is a ceramic or crystalline material.

20. The electron gun of claim 19 wherein the ceramic material is a melted glass frit.

21. The electron gun of claim 18 wherein the insulating material is a polymer.

22. The electron gun of claim 18 wherein the beam-forming electrodes and the layer of insulating material further comprise a bond therebetween to form a laminated beam-forming electrode stack.

23. The electron gun of claim 17 wherein the first, second, and third beam-forming electrodes are formed from a highly doped semiconductor.

24. The electron gun of claim 23 further comprising a layer of insulating material between the beam-forming electrodes, the insulating material being formed by oxidation of the highly doped semiconductor.

25. The electron gun of claim 17 wherein the number of apertures in each of the plurality of aperture clusters is in the range from about 4 to about 55 apertures.

26. The electron gun of claim 17 wherein the number of apertures in each of the plurality of aperture clusters is in the range from about 6 to about 12 apertures.

27. The electron gun of claim 17 wherein the encompassing shape of the clusters is circular or approximately circular and the diameter or major dimension of each of the aperture clusters is in the range from about 40 micrometers to about 2500 micrometers.

28. The electron gun of claim 17 wherein the diameter of each of the apertures in the plurality of clusters is in the range from about 15 micrometers to about 250 micrometers.

29. The electron gun of claim 17 wherein the first, second, and third beam-forming electrodes have a thickness in the range from about 1 micrometer to about 150 micrometers.

30. The electron gun of claim 17 wherein the selected spacings are in the range from about 10 micrometers to about 150 micrometers.

31. The electron gun of claim 17 wherein the encompassing shape of the aperture clusters is selected from shapes consisting of rectangular, elliptical, triangular, circular and polygonal.

32. The electron gun of claim 31 further comprising within the encompassing shape of the aperture clusters an area of the electrodes wherein an aperture spacing is increased to values greater than the aperture spacing at the encompassing shape, so as to decrease spreading of an electron beam.

33. The electron gun of claim 17 wherein the support bracket includes a recessed region adapted to include a monolithic structure including the beam-forming electrodes.

34. A method for manufacturing an electron gun, comprising:

providing a support bracket, the support bracket having a clear aperture and a plurality of alignment holes, the alignment holes being adapted to fit a plurality of first alignment rods, and a plurality of anchor tabs adapted to fit a plurality of second alignment rods;

providing a plurality of beam-forming electrodes, the electrodes having a plurality of aperture clusters and a plurality of alignment holes adapted to fit the plurality of first alignment rods and a plurality of anchor tabs adapted to fit the plurality of second alignment rods;

providing a cathode or cathode holder having anchor tabs and a main lens having anchor tabs;

aligning the cathode or cathode holder, the support bracket and beam-forming electrodes and the main lens by assembling on the first alignment rods; and

affixing the plurality of second alignment rods to the plurality of anchor tabs to form the electron gun.

35. The method of claim 34 further comprising providing an insulating material adapted to be placed between the beam-forming electrodes, the insulating material having clear openings, a plurality of alignment holes adapted to fit the first alignment rod and a plurality of anchor tabs adapted to fit the second alignment rod.

36. The method of claim 35 further comprising bonding the beam-forming electrodes and the insulating material before the step of aligning.

37. A method for manufacturing a beam-forming assembly for an electron gun, comprising:

forming a first doped layer of a semiconductor having a surface;

forming a first insulating layer on the surface of the first doped layer;

forming a second doped layer of a semiconductor on the first insulating layer, the second doped layer having a surface;

forming a second insulating layer on the surface of the second doped layer; and

forming a third doped layer of a semiconductor on the second insulating layer.

38. The method of claim 37 wherein the first and second insulating layers are formed by oxidizing the surface of the first doped layer and the surface of the second doped layer.

39. The method of claim 37 wherein the first and second insulating layers are formed by deposition of an insulating material on the surfaces of the first doped layer and the second doped layer.

40. A method for operating a cathode ray tube, comprising:

operating a cathode to supply a source of electrons;

applying selected values of electrical voltage to first, second and third beam-forming electrodes, the electrodes having a selected thickness and being disposed along and perpendicular to an axis and having selected spacings therebetween, each of the beam-forming electrodes having a plurality of aperture clusters therein, the aperture clusters having a plurality of apertures within an encompassing shape and being aligned in the direction of the axis, so as to form a plurality of collimated beams of electrons; and

applying selected values of electrical voltage to a main lens, the main lens having a range of adjustable focal lengths, so as to adjust the focal length of the main lens and focus the plurality of collimated beams of electrons onto a display screen.